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Spatial transitions, levels of activity, and motivations to exercise during COVID-19: a literature review

Karin Andersson* , Alexander Jansson, Sara Karlén and Jens Radmann

Department of Sport Sciences, Malmö University, Orkanen, Sweden

ABSTRACT

The COVID-19 pandemic and its related measurements have challenged physical activity in various ways, ranging from closed fitness facilities to virtual curfews. Correspondingly, there is currently a rising scholarly interest in investigating how people have navigated their physical activity during the pandemic, and, especially, if physical activity has decreased or not. Accordingly, surveys and studies are rapidly accumulating. Therefore, the purpose of this literature review is to summarize, categorize, and map literature published before May 2021 on physical activity amid COVID-19. This study consists of a mixed methods explanatory sequential design, based on an outcome-oriented pragmatism of the middle. Firstly, a systematic literature review on Scopus was conducted, followed by a VOS-viewer bibliometric analysis. Subsequently, a focused literature review was written. The point of integration of methods was embedded. The systematic review resulted in 1,335 articles, which were used for two separate VOS-viewer visualizations. The illustrations reveal where research comes from, which journals have published most on physical activity during COVID-19, and how the research is globally cited. Furthermore, based on the review, three clear topical trends of research emerge; spatial transitions, frequencies of physical activity, and motivations to exercise during COVID-19. The bibliometric data demonstrates that research from only a few countries seem to be impactful, whereas the review portrays that conclusions in regard to whether physical activity has decreased or not lack agreement, possibly as a result of disclosing different definitions of physical activity.

KEYWORDS

COVID-19; physical activity; literature review; spatial transitions; bibliometric analysis; pandemic sports

Introduction

The COVID-19 pandemic is causing illness, long term health problems, and devastating mortality (Meyerowitz-Katz and Merone 2020). More than a year has passed since the disease was labeled a pandemic, and countries around the world maintain a range of different measures, such as virtual curfews in Israel to time stamped certificates in France, all measurements to prevent a further spread of the disease (Luciano et al. 2021; Narici et al. 2021; Reicher and Stott 2020). Naturally, restrictions that limit social contacts and freedom

CONTACT Karin Andersson  karin.jemima.andersson@mau.se

*Ghent University.

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of movement could have negative effects both on people's mental and physical health (Brooks, et al. 2020; López, et al. 2020; Begović 2020), which could, among other things, lead to considerable inactivity and sedentary¹ lifestyles (Luciano et al. 2021; Narici et al. 2021; Hammami et al. 2020).

Physical activity, henceforth referred to as PA, is defined as any type of skeletal movement that results in energy expenditure (Caspersen, Powell, and Christenson 1985), which could range from performing light garden work to running a marathon. Leading world health organizations such as WHO have, during the pandemic, recommended approximately 150 to 300 minutes of PA per week for adults to support individual health. Statistics show that active individuals have a decreased morbidity risk in relation to COVID-19 (Dwyer et al. 2020), and studies have also shown that PA contributes toward increased mental wellbeing during the pandemic (Stockwell et al. 2021).

The pandemic has caused an inescapable surge in scholarly output investigating COVID-19 related topics within sport sciences (Rowe 2020). However, so far, relatively few literature reviews on PA have been published. Stockwell, et al. (2021) published a systematic literature review of PA, Sedentary, and COVID-19-related literature. They included studies relating to any sort of population (e.g. children, adults, varying medical conditions). They report that out of 44 studies, all but one showed a decrease in PA—although they maintain that physical activities such as gardening and cleaning within the private home sometimes increased. Although COVID-19 is a novel virus, one could assume that other pandemics or natural disasters might have had an effect on PA as well. For example, in 2011 a severe tsunami and hurricane ranged in eastern Japan. It was clearly shown that PA levels decreased as a consequence, and three years later, the PA levels had still not fully recovered (Okazaki et al. 2015, 722). Accordingly, a crisis might lead to sedentary behaviours that, concurrently, trouble some researchers who fear an obesity pandemic (Hall et al. 2021), which points toward the importance of documenting current changes in PA.

Importantly, to date, some conclusions concerning PA during COVID-19 appear contradictory, since some studies promulgate that movement levels have decreased significantly, while other surveys show that PA has remained fairly unchanged (Lesser and Nienhuis 2020; Brand, Timme, and Nosrat 2020; Di Renzo et al. 2020). Ronkainen et al. (2021) address this issue and suggest that studies have measured different sorts of PA ranging from 'cumulated moderate and vigorous physical activity minutes per day, frequency and duration of walking, or exercise session frequency per week' (Ronkainen et al. 2021, 2), without defining the terms thoroughly in their questionnaires. Cheval et al. (2021) voiced a similar critique and adds that it has caused respondents to not consider activities such as cleaning, gardening, and shopping trips as relevant. Furthermore, there is little published bibliometric data that clarifies where PA and COVID-19-related research comes from. Therefore, based on the current status quo of research, the aim of this review will be to map COVID-19 and PA-related research, as well as to summarize some data verbatim that can be considered representative. The broader purpose is thus to contribute toward an increased understanding of what COVID-19 and PA research trends have focused on, where studies are published (e.g. journals, country of origin), and to which extent research output seem to reach out based on citations.

Research questions

- Overall research question: What changes, due to COVID-19, in PA have been reported on in scholarly texts?
- What relationships (e.g. number of citations, journals) emerge between available literature, published before May 2021, on PA and COVID-19?
- How is research about PA and COVID-19, published before May 2021, related to citation and co-citation trends in countries and scientific journals?
- What are the main topics researched on PA during the same timeframe? How do they differ (e.g. what are the main controversies)?

Structurally, firstly, the methodology of this paper will be discussed, followed by a substantial section of results, which, for reasons of cohesion, is divided into two larger sections (quantitative results and qualitative results). Lastly, within the discussion, the quantitative and qualitative outcomes will be compared and contrasted.

Method

This study consists of a mixed methods explanatory sequential design² (Creswell and Clark 2018). Based on an outcome-oriented pragmatism of the middle approach (Johnson and Onwuegbuzie 2004), the mixed methods design was chosen to facilitate complementarity and triangulation, which enables reflexive benefits between the findings from one method with the results of the other methods. The authors also considered that the mixing of methods levels potential shortcomings of one method (Greene, Caracelli, and Graham 1989). The pragmatism of the middle has developed as a compromise between strong realism (e.g. Putnam 2002) and pluralism (e.g. Brandom 2000). The main idea is to let the research questions guide which methods are used instead of epistemological attributes. Step by step, the study began with a quantitative literature search, followed by a quantitative bibliometric search, and, subsequently, a qualitative focused literature review (see Figure 1). The bibliometric data collection employed the program VOS-viewer. Two VOS-viewer visualizations (see Figures 2 and 3) will display the relationship between citation and co-citations, as well as countries and journals. Based on the bibliometric data, a coherent overview and categorization of the selected studies (see Tables 1 and A.1, Appendix), is demonstrated. Subsequently, summaries of selected literature are given under separate subheadings (see Tables 1 and A.1, Appendix).

Search strategy

The authors set out to gain an overview on what has, up until this point, been published on COVID-19 and physical activity. The researchers decided to include sources from various

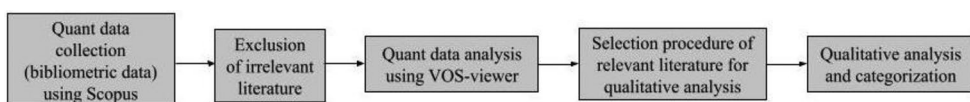


Figure 1. Overview of the method.

Table 1. Categorization of selected studies.

Categories	Spatial transitions e.g. online and outdoor exercising	Amounts of exercise performed	Explorations of exercise-impetus
Studies	Chen et al. (2020)	Ammar et al. (2020)	Andersson and Andreasson (2021)
	Cheval et al. (2021)	Brand et al. (2020)	Clemente-Suárez et al. (2021)
	De Miranda (2020)	Burtscher, Burtscher, and Millet (2020)	Iancheva et al. (2020)
	Ibrahim et al. (2021)	De Jong, Fish, and Hertel (2021)	Kaur et al. (2020)
	Karipidis and Steinfeld (2020)	De la Cámara, Jiménez-Fuente, and Pardos-Sevilla (2020)	Lautenbach et al. (2021)
	Leyton-Roman, de la Vega, and Jimenez-Castuera (2021)	De Lannoy et al. (2020)	Leyton-Roman, de la Vega, and Jimenez-Castuera (2021)
	Marchant et al. (2020)	De la Vega et al. (2020)	Luzi & Radaelli (2020)
	Mutz and Gerke (2021)	Flanagan et al. (2021)	Malcolm & Velija (2020)
	Mutz, Müller, and Reimers (2021)	Hall et al. (2021)	Reicher and Stott (2020)
	Robb et al. (2020)	Malcolm and Velija (2020)	Ruffault et al. (2020)
	Schnitzer et al. (2020)	Moore et al. (2020)	Samuel, Tenenbaum, and Galily (2020)
	Son et al. (2021)	Mutz and Gerke (2021)	Sport England (2020)
	Sport England (2020)	Narici et al. (2021)	Szabo et al. (2019)
	Young (2020)	Phillipou et al. (2020)	
		Robertson et al. (2021)	
		Stockwell et al. (2021)	
		Wilke et al. (2021)	

schools of discipline, ranging from social to natural sciences, in order to provide a holistic mapping of research, consisting of both quantitative and qualitative studies addressing the same topic from diverse angles. The systematic literature search follows the guidelines described in Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Liberati et al. 2009). After considering Webster and Watson's (2002) recommendations that underline the importance of using an interdisciplinary database, Scopus was chosen to systematically search for relevant articles, both because it is the largest database of peer-reviewed literature, but also because the extraction of bibliometric data is compatible with the program for bibliometric analysis used in this study (VOS-viewer) (Moed and Halevi 2014). To perform the search for articles, relevant terms in the title, abstract, and keywords combined with Boolean logical expressions, were used in a search string:

- (sport OR 'physical activity' OR exercise) AND covid*

Study inclusion and exclusion

Original peer-reviewed articles and book chapters published in English in any country before May 2021 were included if they followed the following criteria: (1) observational cross-sectional, longitudinal, prospective or retrospective cohort studies and reports (2) that investigate any form of PA and/or motivations for exercising during COVID-19 (as

defined by the authors in the introduction) (3) in any adult population (e.g. healthy or with specific diseases or conditions) (4) qualitative studies were included if they were deemed information rich according to the author's definition of PA. Furthermore, studies were accepted that built on data collected both prior and during the COVID-19 lockdown. The studies that met the stated criteria were automatically included into the bibliometric sample, whereas further distinctions were made to inclusion in the qualitative literature review. For the focused literature review, articles and book chapters were included that (1) were peer reviewed and written in English and published before May 2021. (2) Focused on aspects of adult PA during COVID-19, (3) observational cross-sectional, longitudinal, prospective or retrospective cohort studies and reports, (4) although focus was put on quantitative studies, qualitative studies were included if they were considered information rich according to the definitions and could clearly correlate to one of the research questions.

Data extraction

The primary and second investigator worked independently and examined potential contributions sequentially. Firstly, information on author, year of publication, geographical location, study imperatives, and, finally, study design was gathered. If the study design and purpose of the study were deemed relevant, the second step was to note information on number of participants, attributes of studies (e.g. gender quota, demographic markers), and recruitment strategies. Subsequently, the findings and results of both authors were extracted, summarized, and critically compared in excel sheets.

An initial search resulted in 1,475 articles; however, 140 articles were deemed irrelevant based on the established definitions and were therefore immediately excluded. After a first cut off, a total number of 1,335 articles remained, whereof all are included in the bibliometric VOS-viewer visualizations. Based on the 1,335 retrieved articles and book chapters, a qualitative selection followed. We used information illustrated in [Figures 2](#) and [3](#) to select articles that aid in answering our research questions, and, also, articles that are representative from a global perspective—has an influence on citations in other countries (according to the VOS-viewer). More precisely, based on the results presented in [Figure 2](#), we carefully examined articles and book chapters that had been cited in several countries. For example, we carefully examined studies from countries with many citations (United Kingdom, USA, Italy, Spain, and Australia), which met the inclusion criteria. Furthermore, we carefully cross-examined articles that were frequently cited within a group (cluster) of countries (clusters are illustrated by colours in [Figure 2](#)). Subsequently, frequently cited clusters (countries in green, red, brown, orange, blue, turquoise, and yellow colours) were contrasted. Based on the results presented in [Figure 3](#), we carefully examined articles that were published in journals that had a high number of co-citations. Furthermore, we considered the diversity of the articles, which were published in journals from various scientific fields such as (1) health sciences, (2) medical sciences, (3) environmental health sciences and public health, (4) psychology, and (5) education. The undertaken bibliometric analysis presented in [Figures 2](#) and [3](#), directed the selection of articles. Based on the listed criteria and outcomes of the quantitative analysis, 58 articles were categorized pertinent for the qualitative analysis (see [Table 1](#)). To decide which texts to include into the focused review, texts were chosen that (1) were part of different citation clusters (see [Figure 3](#)) (2) texts that either correlated or differed strongly in their results, and, articles that clearly answered one of the research questions. These criteria

were selected to avoid reproducing the citation clusters found through the bibliometric analysis, and to provide insights into the diverse status quo of research.

Quality assessment

Based on the guidelines of previous research (see Modesti et al. 2016; Wells, Shea, and O'Connell 2009), the quality assessment of studies was conducted following the recommendations of the Newcastle-Ottawa Scale (NOS). As such, based on the inclusion and exclusion criteria (stated above) the primary and secondary investigator rated the quality and relevance of the studies collected in Scopus. In those cases when the quality and relevance of particular studies were ambiguous, the third or fourth author were consulted.

Bibliometric method

The bibliometric analysis is conducted in two steps, using VOS-viewer and the association strength analysis (for more information see Perianes-Rodriguez, Waltman, and Van Eck 2016; Van Eck and Waltman 2014). Firstly, we analyse the relationship between *citations* and *countries*. Secondly, fractional counting was used to analyse the relationship between *co-citations* and *journals*. The results are presented in two colourful figures that emphasize the mentioned nodal points.

Results

The relationship between citations and countries shows some clear trends. The first illustration provides information concerning from which countries the available research articles stem, and, secondly, more interestingly, how articles from a particular country possibly impact research in other countries. In the visualization, the size of the circles illustrates the numbers of citations, as such, larger circles illustrate countries with a larger number of citations. The lines between countries illustrate a relationship. More precisely, lines illustrate that articles from one country are cited in articles from another country. Wide lines illustrate that there is a stronger relationship, thin lines illustrate that there is a weaker relationship, and no lines illustrate that there is no relationship at all. By examining the bibliometric data, the results show that the articles ($N = 1,335$) are derived from 125 countries. The countries with a minimum of five published articles are included in the illustration (56 countries). As illustrated in [Figure 2](#), the results depict that the countries with most citations are The United Kingdom, USA, Italy, Spain, and Australia. The most prominent result from the bibliometric data is that articles published in The United Kingdom and USA are most frequently cited. This indicates that articles in those countries also have had the strongest scientific impact on articles published in other countries. The second most striking result to emerge from the data is that there appears to be no relationship between a large number of cited articles and countries.

The results show that there is a clear relationship between journals and co-cited articles about PA and COVID-19. The analysis provides information on which scientific fields and which specific journals and groups of journals have had the most co-citations. In the

visualization (Figure 3), lines illustrate a significant relationship, namely; two journals that are both cited within the same article. The size of the circles illustrates the numbers of citations, as such, larger circles illustrate journals with a larger amount of citations. The distance between the circles infers a connection. A smaller distance illustrates a higher number of co-citations between journals. The colours of journal's names cluster journals according to scientific disciplines, for example, health sciences, psychology, and clinical medicine.

The outcomes manifest that the articles ($N = 1,335$) have been published in 621 different journals. Only 36 journals have published five (or more) studies on PA and COVID-19. Given that each circle represents the activity of the journal, measured in terms of publications, the results also reveal which few journals have published the most on PA and COVID-19. A crucial observation is that research on PA and COVID-19 is mainly co-cited within only a few journals and five fields: (1) health sciences (journals in blue colours), (2) medical sciences (journals in green colours), (3) environmental health sciences and public health (journals in red colours), (4) psychology (journals in yellow colours) and, (5) education (journals in purple colours).

Discussion

The bibliometric data points toward a number of noteworthy indications. For example, as illustrated in Figure 3, one can clearly observe citation clusters. Given that PA and COVID-19 is of global concern, this raises a number of questions regarding *how*, and *to which extent* research on PA and COVID-19 becomes available, relevant, and generalizable outside countries' own borders and across disciplines. As such, the results from this study indicate that important findings about PA and COVID-19 quite rarely have a global impact, according to co-citation figures. Instead, particular articles seem to be frequently noticed and cited in some countries, however, rarely or never in other countries. Although one could argue that the research is still quite recently published, and, potentially, therefore not frequently cited at this point, the bibliometric sample can be considered representative, since two identical searches were performed to ensure representativity (two searches with the same criteria on year 2020 and 2021 were performed). Both searches pointed toward the same citation trends. However, the number of citations, disregarding the clusters, also have to do with journal rankings and impact factors. For instance, in Figure 3, Lancet appears as the most visible name, and is also the second highest ranked journal worldwide. As a matter of fact, the four most visible journals in Figure 3 (International journal of environmental research and public health, Plos one, Jama, Nutrients) all have extraordinarily high rankings, high impact factors, as well as open access, which clearly simplifies a rapid spread toward a large audience of readers. However, we maintain that the valuable insights are that, even if many of the journals claim to be interdisciplinary, citations are limited to certain clusters that seem to be divided according to disciplines, suggesting a bias in citation and/or limited influence across disciplines and countries.

Trends of research

Based on the previously discussed quantitative literature search, one could divide the focus of existing research on COVID-19 and adult PA into three overarching categories: spatial

transitions, amounts of exercise performed, and explorations of exercise-impetus. The following sections will address these categories sequentially (see [Table 1](#)).

Qualitative review

Within the following section, literature from the above list will be summarized below allocated subheadings corresponding to the three main categories that emerged based on the systematic Scopus and bibliometric search (for inclusion criteria, see *Data Extraction*).

Spatial transitions

The pandemic has resulted in various types of transitions in the world of sport, including changes in both venues and practices. Schlossberg (1981, 5) defines a transition as ‘an event or non-event which results in a change in assumptions about oneself and the world, which, respectively, requires a corresponding change in one’s behaviour and relationships’. The scholars Karipidis and Steinfeld (2020), who are active within sport didactics and sport psychology at Bloomington University, Indiana, argue that COVID-19 is a non-normative transition; imposed involuntarily and occurring unexpectedly. In a reflective book chapter, they reason around both negative and positive outcomes of forced transitions for elite sport practitioners. Taking an American perspective, they consider that college and University athletes who were sent home from campuses were exposed to challenges such as ‘poor nutrition, decreased sleep quality, and substance use’ (Karipidis and Steinfeld 2020, 255). However, encouraging a long-term perspective, they also underline that the enforced time-out in a different setting may result in an increased level of intrinsic motivation to return to sport. Yet, the everyday exercise routines of fitness enthusiasts are equally important to consider. The scholar of human movement sciences, Young (2020), reports that leisure sports such as volleyball, windsurfing, and recreational swimming have been suspended in South Africa, since beaches are closed off. In the Tyrolean area of Austria, which was severely virus stricken, a survey ($n=511$) investigated how a strict curfew, closed sport facilities, and prohibition of other outdoor sport activities (e.g. mountainbiking, orienteering) had an impact on exercising behaviours between the 16th of March until the 7th of April 2020. The results convey that pending the severe limitations in sport opportunities, jogging, walking, and hiking became substitutes (Schnitzer et al. 2020).

Alongside outdoor exercising, virtual fitness performed in the private home is probably globally the most common strategy of relocation. Due to the urgent need for home-based exercising, offers have increased rapidly ranging from on-demand services to live streamed classes organized by both gyms, public service, sport clubs, and private individuals (Andersson and Andreasson 2021). A further virtual alternative are e-health applications that are distinguished by providing short and intensive workouts that can be performed in small spaces and stand out as interactive alternatives where users may share their activities on social media (Marchant et al. 2021). The Chinese sport scientist Ling (2020) studied surveys conducted in China that led her to ascertain that home-based exercising has become a new and trending lifestyle in China. She mainly bases the assumption on comparisons of expenses spent on sport equipment for private households. Son et al. (2021), who conduct research on elderly people and movement, underline that home workouts are especially

essential to older people, since they may need to remain in quarantine longer than a younger population. Ibrahim et al. (2021), who focuses on age-related rheumatism and rehabilitation, conducted a qualitative longitudinal study with ($n = 43$) senior citizens suffering from arthritis in Malaysia, to investigate how virtual home fitness practices would impact anxiety levels. Contrary to a similar study conducted in the UK (Robb et al. 2020), Ibrahim et al.'s (2021) results could not validate any improvement in anxiety levels. Adding to this, the German sport scientists Mutz, Müller, and Reimers (2021), conclude that elderly are the least likely group to employ online fitness alternatives, based on lack of technical literacy as well as motivation, which are obstacles that were also mentioned by others when referring to elderly and online fitness alternatives (Young 2020; De Miranda 2020). Mutz, Müller, and Reimers (2021) further report that every fifth German (19%) older than fourteen used online fitness frequently, and 23 percent of the respondents operated a digital fitness alternative at least once during the first lockdown in Germany, which corresponds like for like to results of a UK survey (Sport England 2020). Mutz, Müller, and Reimers (2021) emphasize that their large-scaled cross-sectional survey ($n = 1508$) also reveals that women and younger people are overrepresented on fitness apps, as well as people with higher income and education.

This section has discussed literature that reports on spatial transitions for physical activity. There is strong agreement in how people have navigated their movement; either to outdoor venues, or exercising within the private home, often accompanied by fitness apps or on-demand services. However, while home exercising is described as a new lifestyle trend in China (Ling 2020), it is reported to be a practice that is mainly adapted by a younger population consisting of more women than men in Germany (Mutz, Müller, and Reimers 2021), and it functions as a temporary substitute that cannot replace sport facilities, gyms, or face-to-face instruction (Mutz, Müller, and Reimers 2021; Andersson and Andreasson 2021), which indicates global differences in the perceptions of desired physical activity.

COVID-19s impact on exercise frequencies

Science has established, through studies conducted both before and during COVID-19, that regular physical exercise is incontrovertible for one's health, and reaching back to the fact that obesity was even labelled a pandemic in 2012, exercise appears to be an urgent societal concern. Since the 1980s, everyday exercise has mainly been marketed as an individual responsibility that individuals should pursue in their spare time (Crawford 2006); becoming practices taking place in gyms or sport clubs. For example, the fact that exercising outdoors has been allowed in (some) lockdown zones manifests its place in contemporary western societies, as well as the success of promoting it as an individual precaution toward health upkeep (Malcolm and Velija 2020, 30). Yet, since many corporeal facilities are presently on time-out, bodily maintenance has reached *terra incognita*—demanding higher levels of personal initiative and commitment to exercise. In the words of the neurological sport scientists Burtcher and colleagues (2020), 'people will need to find opportunities to exercise despite quarantine habitus'. The sport scholars Wilke et al. (2021), who specialize in sport injuries, published a multinational assessment survey ($n = 13,503$) on self-reported sport participation, examining levels of PA prior and during the first months of the pandemic. Their survey on adults circulated in fourteen countries and shows a 41 percent reduction in moderate and vigorous exercising. They conclude that elderly and younger adults declined the most in PA.

Although previous research has suggested that activity levels tend to decrease during a crisis (Okazaki et al. 2015; Hall et al. 2021; Chen et al. 2020), activity levels during COVID-19 are also reported to remain fairly stable, or even to increase, especially, for adults not belonging to a so-called risk group (Mutz and Gerke 2021). De la Cámara, Jiménez-Fuente, and Pardos-Sevilla (2020), affiliated with the sport science department in Madrid, also implemented a cross-sectional study ($N=797$) in Spain, and reached a similar conclusion. They convey that people who were not active before the pandemic both performed and expressed to have an increased interest in exercise, a fact they argue should be employed by the government to keep-up the newly arisen interest in movement (2020, 4). The health and exercise psychologist Cheval et al. (2021) conducted a longitudinal survey utilizing self-reporting scales during the first and second lockdown in France and Switzerland. They maintain that although high intensity activities decreased, moderate levels of activity such as walking increased. A further aspect to consider is shown through a google survey with 1079 participants from seven Spanish-speaking nations conducted by the sport psychologists de la Vega et al. (2020). They explore how exercise addiction (habitual PA that has become compulsive) affected exercise frequencies during lockdown. They note that 81 percent of their informants state to exercise to remain healthy, and this group showed less decrease in PA than the respondents who report to exercise because of social components.

The results from a survey ($n=1,141$) on PA in Sweden during the first wave of the pandemic conducted at the department of sport sciences at Malmö University, show that there is a great deal of variation in how COVID-19 has affected the respondents' participation in sports. The results show that approximately the same number of respondents answer that their sport participation has decreased to a high degree (20% to 21%) and to a low degree (16% to 19%). A comparatively large amount (29%–30%) of the respondents 'strongly disagree' that their physical activity has decreased as a result of COVID-19 (Andersson et al. 2021). Correspondingly, the sport scientists Leyton-Roman, de la Vega, and Jimenez-Castuera (2021), distributed a survey ($n=179$) in Spain including participants only who claimed to be physically active (more than 150 minutes of exercise per week) prior to lockdown. They conclude, 'those who are more intrinsically motivated to practice physical activity are more likely to remain physically active' (Leyton-Roman, de la Vega, and Jimenez-Castuera 2021, 4).

Based on a cross-sectional online survey, Brand, Timme, and Nosrat (2020), experts in kinesiology at the University of Potsdam, examined exercise-related routines during COVID-19 consisting of 13,696 respondents throughout eighteen countries. They promulgate that the respondents who exercised on an everyday basis pre-COVID-19 tended to maintain it, and even respondents who rarely exercised before, stated to increase their amount of exercise per week. Accordingly, PA frequencies prior to the pandemic seem to play a role. Another aspect that correlated with maintained or increased PA was nutritional choices. The obesity researchers Flanagan et al. (2020) conducted a comparative online survey ($n=7,753$), exploring physical activity, mental health, and dietary habits of adults before and during the pandemic. The results reveal that eating healthier increased, since people cooked more themselves. While anxiety levels rose in all groups, activity levels only decreased for one group—those with an elevated BMI.

However, there are also studies that report clear decreases of physical activity. For instance, Ammar et al. (2020) who collected respondents for their survey ($n=1,047$) from four continents, affirm that activity levels dropped in all respects; sitting down more than

eight hours a day rose from 24 percent (pre-pandemic) to 29 percent (during). The number of walks undertaken per week decreased with 35 percent, which is a significant reduction.

Further mixed results are established by a questionnaire ($N=1,001$) that was spread throughout Germany by the German sport sociologists Mutz and Gerke (2021). The questionnaire investigates activity levels of adults and resulted in three groups—informants considered inactive both pre-pandemic and during (36%), people who maintained or increased their physical activity (33%), and those who reduced (31%) (Mutz and Gerke 2021).

Phillipou et al. (2020), who specialize in eating disorders, disseminated a national survey in Australia on April 1st 2020. 5,469 randomly chosen informants took the survey that looked into eating and exercising behaviours during COVID-19. They could conclude that 34.8 percent moved more, whereas 43.4 percent moved less. Those who reported increased binge eating also decreased their physical activity (Phillipou et al. 2020, 1163). Notably, various undertaken studies during COVID-19 have shown that informants who have an eating disorder are the only respondent cluster who have increased their PA (Stockwell et al. 2021).

The literature indicates that it is difficult to point toward clear general trends of physical activity during COVID-19. A significant factor seems to be how much exercise the respondents performed before the pandemic. The results convey that those who stated to already be physically active remained so, or even increased their activity levels. However, two other aspects that appear important are age and health status. For instance, De Lannoy et al. (2020), who looked at activity levels during different phases of the pandemic, conclude that activity patterns of Canadian children decreased, and young adults also reduced their activity, however, only at the outset of the pandemic (Mutz and Gerke 2021). Narici et al. (2021, 2) also underline that people older than 60 years of age are the group that has decreased their activity level the most, while Flanagan et al. (2021) conclude that people with obesity moved considerably less. Accordingly, these results suggest that infection-fears could strongly impact exercising behaviours, since, although social distancing was directed toward everyone, elderly are considered a risk group and young adults are deemed as main spreaders. In addition, external factors such as curfews also impact activity. Moore et al. (2020), De Lannoy et al. (2020), and Narici et al. (2021) point out that inactivity levels, particularly, seem to increase in areas where severe restrictions of movement are implemented.

Motivations to exercise during COVID-19

The following section will discuss how motivations³ to be physically active have changed or been influenced during the pandemic. This topic seems particularly urgent to address, since the closure of various sporting facilities, the postponement of tournaments, as well as restrictions regarding how many people may perform sport together, could put the motivation to be active to the test (Andersson et al. 2021). Various scholars have even underlined that they estimate that COVID-19 will have a noticeable negative impact on motivations to exercise (Clemente-Suárez et al. 2021; Iancheva et al. 2020; Samuel, Tenenbaum, and Galily 2020). Simultaneously, Szabo, Boros, and Bősze (2019) point out that PA is a way of coping with stress, which would explain why some seem to exercise more. Furthermore, achievement motivation theory divides motivation to participate in sport into two main branches—intrinsic and extrinsic motivation. Those who are intrinsically motivated wish to develop sport-specific skills and put their personal progress at the forefront, whereas the

extrinsic exerciser prioritizes competition with others and the central theme becomes excelling (Reinboth and Duda, 2006).

The sport scientists De Jong, Fish, and Hertel (2021), who specialize in sport injuries at the University of Virginia, disseminated a survey with 1,147 respondents from fifteen countries that investigated hobby runner's motivation and running frequencies. They concluded that the intensity of the runs decreased while the volume increased. The de-motivation reported in regard to running was rooted in fear of COVID-19s effects on running possibilities (20%), and a lack of satisfactory training results (De Jong, Fish, and Hertel 2021, 10).

Robertson et al. (2021), who are researching topics related to body weight stigma at the University of Edinburgh, are actively working on a longitudinal study ($n = 264$) in the UK that zooms in on changes in exercise, eating, and body image in relation to COVID-19. Similar to others, they convey that results vary to a great extent, but they stress that women, young adults, and people who reported psychological distress displayed more motivation to exercise. The increased interest in PA could indicate positive changes in motivational levels, but it could also mirror compulsive behavioral changes, driven by heightened anxiety and weight and shape concerns (Meyer et al. 2011). A study undertaken by Sport England (2020) reveals that 56 percent of the informants agreed to the fact of feeling guilty unless they exercised. Adding to this, a qualitative study of fifteen group fitness instructors residing in ten different countries indicate that they felt severe pressure to keep up athletic physiques during lockdown to maintain their professionalism within the fitness industry (Andersson et al. 2021), while the sport sociologists Malcolm and Velija (2020) argue that exercising during the pandemic mirrors a disciplining process. Nevertheless, moderate external pressure to exercise has shown to have positive effects. For example, the sport psychology scholars, Ruffault et al. (2020) conducted a cross-sectional study consisting of 759 competitive athletes active in France during 2020. They report that athletes who were closely monitored by strict schedules articulated high levels of motivation to be physically active during lockdown. The supervised sportsmen also showed lower levels of anxiety than those less monitored, which could indicate that a certain level of regulation could have a positive effect on motivational levels in team sport during a crisis. Adding to this, they infer that anxiety might lead to an increased risk of injury when working out. Their survey reveals that women, young adults, and elite athletes reported the highest levels of anxiety.

Moderate amounts of physical activity is promoted and recommended in times of crisis by WHO, NHS, ACSM, and other influential health organizations. However, an excess of exercise could cause a suppression of the immune function, which points toward a paradox; someone who is 'too motivated' may not gain benefits from their training (Dwyer et al. 2020, 1291). Szabo (2010) who specialize in exercise behaviours have reported that individuals who regularly exercise at high intensities, easily reach a tolerance level. From this point onwards, they must progressively increase their training to uphold results, which may lead to a training addiction and a pattern that is no longer healthy. The Indian-based sport scientists Kaur et al. (2020) conducted a qualitative study with 22 highly active adult respondents (by the authors referred to as fitness freaks) residing in India during the first lockdown period. They investigated lived experiences of confinement in individuals who usually visited a gym on a daily basis. They describe that participants state to feel deprived without access to gyms, and, therefore, articulated low motivations to exercise at home where advanced routines could not be practiced due to lack of equipment.

One demographic marker that appears significant within the reviewed literature regarding motivation and PA is sex—women are reported to show decreased motivation to exercise. A survey ($n=95$) that looked into recreational exerciser's motivation to be active in Germany, conducted by researchers at the department of sport sciences in Leipzig during April and May 2020, assert that women reported reduced levels of motivation to exercise (Lautenbach et al. 2021). Supporting this claim, the sport scientists Leyton-Roman, de la Vega, and Jimenez-Castuera (2021), who distributed a survey ($n=179$) in Spain comprised by participants who claimed to be physically active (more than 150 minutes of exercise per week) prior to lockdown, concur that motivation to perform PA declined significantly in female respondents.

To summarize, this section has discussed literature that discuss motivations, often categorized as either intrinsic or extrinsic, to perform PA during the COVID-19 pandemic. Some studies suggest that exercise during the pandemic adds a moral dimension—becoming a disciplining process (Malcolm and Velija 2020), fuelled by a notion that individual health is the one thing that one can control. In connection to this, exercise could also contribute toward a feeling of self-control during a crisis when other aspects of one's environment might be influenced by external factors (Luzi and Radaelli 2020). However, other studies have also shown that external supervision can have a positive impact on PA impetus (Ruffault et al. 2020). Lastly, some results demonstrate that women's motivational levels have decreased more in comparison to men (Lautenbach et al. 2021; Leyton-Roman, de la Vega, and Jimenez-Castuera 2021), although one study inferred the opposite (Robertson et al. 2021).

Conclusion

This paper has, by utilizing both quantitative and qualitative methods, summarized literature that discussed different aspects of PA during the COVID-19 pandemic. The systematic literature review initially resulted in 1,335 articles and point toward three main topics within COVID-19 and PA-related research; spatial transitions, amounts of performed PA (often in comparison to pre-pandemic), and motivations for PA during the pandemic. Adding to this, two further minor categories also surfaced. Firstly, comments and advice concerning promotion of PA during a crisis, and, secondly, reflections on ways back to PA post-lockdown. 58 studies were considered information rich and representative for the narrative focused literature review where the three main categories were discussed in depth.

The bibliometric data analysis reveals that, although COVID-19 and PA-related research is produced within a wide range of interdisciplinary scientific disciplines, the co-citation frequencies convey that the majority of the research has not been cited, or, is mainly cited within clusters that seem to be divided according to narrow disciplines. The analysis shows that certain clusters of publications, mainly output from The United Kingdom, USA, Italy, Spain, and Australia are cited repeatedly, which questions the impact output has, if it does not spread beyond national or disciplinary borders. This finding can also be strengthened by the qualitative literature search where some studies appeared often in citation.

Disruptions in PA, including shifts in venues, initially proved to cause both anxiety and loss of motivation to perform PA in lockdown habitus (Kaur et al. 2020). However, the forced pause is also argued to enable time to both improve sport specific skills, and to

reassess one's priorities in regard to PA (Karipidis and Steinfeld 2020). Motivations to exercise were usually categorized with the variables intrinsic or extrinsic. Studies generally show that those who were intrinsically motivated exercised more, whereas the latter group lost motivation when competitions seized. Also, respondents who claimed to be physically active prior to the outbreak of the pandemic, were likelier to remain active in lockdown habitus. People who were categorized as having eating disorders or compulsive training behaviours also continued to be active, or even increased their PA.

Following social distancing and stately promotion of virtual fitness, internet use has become more frequent as well as a more accepted platform for PA (Marchant et al. 2021). The discussed literature pinpoints spatial transitions to consist of either virtual PA, outdoor exercising, or a combination of both. Although all studies conform in describing where PA has navigated, the results differ in terms of attitudes toward the changes. While increased time outdoor seems to correlate with positive changes such as reduced anxiety levels, virtual fitness and e-health applications are both described as temporary solutions or even last resorts. Yet, virtual alternatives have gained followers who enjoy the (pseudo) social aspect of sharing PA results on social media platforms, and in one case 'at home fitness' is also referred to as a new lifestyle trend in China (Ling 2020). As was referred to earlier, governments in various countries have encouraged residents to remain physically active during lockdown, suggesting how time could be spent 'productive' at home (Malcolm and Velija 2020, 31). Arisen out of local consent and welfarism, countries such as the UK and Sweden, where state interventions are generally well received, people are more likely to take a stately exercising imperative seriously in contrast to in France, USA, or Brazil (Reicher and Stott 2020, 696). Further aspects concerning virtual PA also emerged; some authors stress that virtual PA options are not equally accessible to all, both based on technical literacy (Portegijs et al. 2021) and financial situation (Young 2020).

For further research, researchers could consider exploring some contradicting data. For instance, the literature reveals that elderly, children, and in some cases, women and young adults have reduced their PA the most. Nonetheless, there are deviating results; for example, Mutz and Gerke (2021) displayed that women and young adults were considerably more frequent users of e-health applications, which rendered them more active within their survey. Additionally, further distinctions when PA is investigated appear necessary. For example, some large-scaled and globally diverse surveys (e.g. Brand, Timme, and Nosrat 2020; Meyer et al. 2020; Stanton et al. 2020; Wilke et al. 2021) have reached quite contradictory conclusions when discussing levels of PA during the pandemic, which indicates that, up until this point, differences in employed research questions, variables used, and definitions of PA, have, possibly, resulted in differing and even contradicting conclusions. Further aspects to consider while comparing results are context specific aspects such as governmental restrictions that could have an effect on the possibilities of PA. Authors could also consider ways of avoiding a decrease in PA during a crisis, based on this and other similar literature reviews.

Limitations to the study

Considering that the COVID-19 pandemic is a relatively recent crisis, the scholarly publications are still limited and of heterogenous quality. There is also a lack of previous studies that has investigated PA in relation to pandemics, which made a theoretical point of

departure more difficult. Due to limitations of space, the authors constrained their review to using Scopus. However, they acknowledge that there are other databases that could have been equally fruitful. The authors also admit that literature published in another languages than English are not included in the review. Therefore, this review may not provide an exhaustive account of output, but could rather be treated as a point of departure for further research.

Notes

1. Sedentary (SE) is defined as any activity sitting or lying down such as screening activities or desk work.
2. This is a sequential design, since the second part of the project (the qualitative review) is dependent on the first part and conducted at a later point. The emphasis given to the data is QUAN/qual. Terminologically speaking, the approach is explanatory, since the second component (qual) is used to explain the results of the initial method. The point of integration between methods is in the discussion (QUANT) (Creswell and Clark 2018).
3. Motivation refers to the extent to which 'behavior is selected, directed, energized, and maintained to satisfy a particular motiv   (Kaz  n and Quirin 2018, 15).

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ORCID

Karin Andersson  <https://orcid.org/0000-0003-1763-9428>

References

- Ammar, A., M. Brach, K. Trabelsi, H. Chtourou, O. Boukhris, L. Masmoudi, B. Bouaziz, On Behalf of the ECLB-COVID19 Consortium, et al. 2020. "Effects of COVID-19 Home Confinement on Eating Behaviour and Physical Activity: Results of the ECLB-COVID19 International Online Survey." *Nutrients* 12 (6): 1583. doi:10.3390/nu12061583.
- Andersson, K., and J. Andreasson. 2021. "Being a Group Fitness Instructor during the COVID-19 Crisis: Navigating Professional Identity, Social Distancing, and Community." *Social Sciences* 10 (4): 118. <https://www.mdpi.com/2076-0760/10/4/118>. doi:10.3390/socsci10040118.
- Andersson, K., U. Vogl, and J. Andreasson. 2021. "Working out Covid-19: Being a Les Mills Instructor and Managing Health in Times of Quarantine." In *Time Out: Sport and the Corona Lockdown*, edited by A. H. J  rg Krieger, Paul Dimeo, and Lindsay Parks Pieper. Common Ground Network. doi:10.18848/978-1-86335-232-1/CGP.
- Begovi  , M. 2020. "Effects of COVID-19 on Society and Sport a National Response." *Managing Sport and Leisure* 6: 1–6. doi:10.1080/23750472.2020.1779115.

- Brand, R., S. Timme, and S. Nosrat. 2020. "When Pandemic Hits: Exercise Frequency and Subjective Well-Being during COVID-19 Pandemic." *Frontiers in Psychology* 11: 570567. doi:[10.3389/fpsyg.2020.570567](https://doi.org/10.3389/fpsyg.2020.570567).
- Brandom, R. B. 2000. *Rorty and his critics*. Malden, MA: Blackwell.
- Brooks, S. K., R. K. Webster, L. E. Smith, S. Woodland, S. Wessely, N. Greenberg, and G. J. Rubin. 2020. "The Psychological Impact of Quarantine and How to Reduce It: Rapid Review of the Evidence." *The Lancet* 395 (10227): 912–920. doi:[10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8).
- Burtscher, J., M. Burtscher, and G. P. Millet. 2020. "(Indoor) Isolation, Stress, and Physical Inactivity: Vicious Circles Accelerated by COVID-19?" *Scandinavian Journal of Medicine & Science in Sports* 30 (8): 1544–1545. doi:[10.1111/sms.13706](https://doi.org/10.1111/sms.13706).
- Caspersen, C. J., K. E. Powell, and G. M. Christenson. 1985. "Physical Activity, Exercise, and Physical Fitness: Definitions and Distinctions for Health-Related Research." *Public Health Reports (Washington, DC: 1974)* 100 (2): 126–131.
- Chen, P., L. Mao, G. P. Nassis, P. Harmer, B. E. Ainsworth, and F. Li. 2020. "Coronavirus Disease (COVID-19): The Need to Maintain Regular Physical Activity While Taking Precautions." *Journal of Sport and Health Science* 9 (2): 103–104. doi:[10.1016/j.jshs.2020.02.001](https://doi.org/10.1016/j.jshs.2020.02.001).
- Cheval, B., H. Sivaramakrishnan, S. Maltagliati, L. Fessler, C. Forestier, P. Sarrazin, D. Orsholits, et al. 2021. "Relationships between Changes in Self-Reported Physical Activity, Sedentary Behaviour and Health during the Coronavirus (COVID-19) Pandemic in France and Switzerland." *Journal of Sports Sciences* 39 (6): 699–704. doi:[10.1080/02640414.2020.1841396](https://doi.org/10.1080/02640414.2020.1841396).
- Clemente-Suárez, V., E. Navarro, M. Jimenez, A. Hormeño-Holgado, M. Martinez-González, J. Benítez Agudelo, N. Perez-Palencia, C. Laborde-Cárdenas, and J. Tornero-Aguilera. 2021. "Impact of COVID-19 Pandemic in Public Mental Health: An Extensive Narrative Review." *Sustainability* 13 (6): 3221. doi:[10.3390/su13063221](https://doi.org/10.3390/su13063221).
- Crawford, R. 2006. "Health as a Meaningful Social Practice." *Health (London, England: 1997)* 10 (4): 401–420. doi:[10.1177/1363459306067310](https://doi.org/10.1177/1363459306067310).
- Creswell, J. W., and V. Clark. 2018. *Designing and Conducting Mixed Methods Research*. 3rd ed. Thousand Oaks: Sage.
- De Jong, A. F., P. N. Fish, and J. Hertel. 2021. "Running Behaviors, Motivations, and Injury Risk during the COVID-19 Pandemic: A Survey of 1147 Runners." *PLoS One* 16 (2): e0246300. doi:[10.1371/journal.pone.0246300](https://doi.org/10.1371/journal.pone.0246300).
- De la Cámara, Miguel Á., Augusto Jiménez-Fuente, and Ana I. Pardos-Sevilla. 2020. "Confinement Time Due to the COVID-19 Disease: An Opportunity to Promote and Engage People in Regular Physical Exercise?" *Translational Sports Medicine* 4 (1): 3–5. doi:[10.1002/tsm2.170](https://doi.org/10.1002/tsm2.170).
- De la Vega, R., L. J. Almendros, R. R. Barquín, S. Boros, Z. Demetrovics, and A. Szabo. 2020. "Exercise Addiction during the COVID-19 Pandemic: An International Study Confirming the Need for considering Passion and Perfectionism." *International Journal of Mental Health and Addiction* 12 (1): 1–12. doi:[10.1007/s11469-020-00433-7](https://doi.org/10.1007/s11469-020-00433-7).
- de Lannoy, Louise, Ryan E. Rhodes, Sarah A. Moore, Guy Faulkner, and Mark S. Tremblay. 2020. "Regional Differences in Access to the Outdoors and Outdoor Play of Canadian Children and Youth during the COVID-19 Outbreak." *Canadian Journal of Public Health = Revue Canadienne de Sante Publique* 111 (6): 988–994. doi:[10.17269/s41997-020-00412-4](https://doi.org/10.17269/s41997-020-00412-4).
- De Miranda, D. S. 2020. "Citizenship and Leisure in Pandemic Times." *World Leisure Journal* 62 (4): 303–305. doi:[10.1080/16078055.2020.1828785](https://doi.org/10.1080/16078055.2020.1828785).
- Di Renzo, L., P. Gualtieri, F. Pivari, L. Soldati, A. Attina, G. Cinelli, and C. Leggeri. 2020. "Eating Habits and Lifestyle Changes during COVID-19 Lockdown: An Italian Survey." *Journal of Translational Medicine* 18 (229): 1–15. doi:[10.1186/s12967-020-02399-5](https://doi.org/10.1186/s12967-020-02399-5).
- Dwyer, M. J., M. Pasini, S. De Dominicis, and E. Righi. 2020. "Physical Activity: Benefits and Challenges during the COVID-19 Pandemic." *Scandinavian Journal of Medicine & Science in Sports* 30 (7): 1291–1294. doi:[10.1111/sms.13710](https://doi.org/10.1111/sms.13710).
- Flanagan, E. W., R. A. Beyl, S. N. Fearnbach, A. D. Altazan, C. K. Martin, and L. M. Redman. 2021. "The Impact of COVID-19 Stay-at-Home Orders on Health Behaviors in Adults." *Obesity* 29 (2): 438–445. doi:[10.1002/oby.23066](https://doi.org/10.1002/oby.23066).

- Greene, J. C., V. J. Caracelli, and W. F. Graham. 1989. "Toward a Conceptual Framework for Mixed-Method Evaluation Designs." *Educational Evaluation and Policy Analysis* 11 (3): 255–274. doi:10.2307/1163620.
- Hall, G., R. L. Deepika, A. P. Shane, J. L. Carl, and A. Ross. 2021. "A Tale of Two Pandemics: How Will COVID-19 and Global Trends in Physical Inactivity and Sedentary Behavior Affect One Another?" *Progress in Cardiovascular Diseases* 64: 108–110. doi:10.1016/j.pcad.2020.04.005.
- Hammami, A., B. Harrabi, M. Mohr, and P. Krusturup. 2020. "Physical Activity and Coronavirus Disease 2019 (COVID-19): Specific Recommendations for Home-Based Physical Training." *Managing Sport and Leisure* 4: 1–6. doi:10.1080/23750472.2020.1757494.
- Iancheva, T., L. Rogaleva, A. Garcia-Mas, and A. Olmedilla. 2020. "Perfectionism, Mood States, and Coping Strategies of Sports Students from Bulgaria and Russia during the Pandemic Covid-19." *Journal of Applied Sports Sciences* 1 (2020): 22–38. doi:10.37393/JASS.2020.01.2.
- Ibrahim, A., M. C. Chong, S. Khoo, L. P. Wong, I. Chung, and M. P. Tan. 2021. "Virtual Group Exercises and Psychological Status among Community-Dwelling Older Adults during the COVID-19 Pandemic-A Feasibility Study." *Geriatrics* 6 (1): 31. doi:10.3390/geriatrics6010031.
- Johnson, R. B., and A. J. Onwuegbuzie. 2004. "Mixed Methods Research: A Research Paradigm Whose Time Has Come." *Educational Researcher* 33 (7): 14–26. doi:10.3102/0013189X033007014.
- Karipidis, T., and J. A. Steinfeld. 2020. "Potential Benefits of Covid-19 Transition for Athletes: Unintended Consequence." In *Sport and the Pandemic: Perspectives on Covid-19's Impact on the Sport Industry*, edited by M. Paul, P. M. Pedersen, B. J. Ruihley, and B. Li. Routledge. doi:10.4324/9781003105916.
- Kaur, H., T. Singh, Y. K. Arya, and S. Mittal. 2020. "Physical Fitness and Exercise during the COVID-19 Pandemic: A Qualitative Enquiry." *Frontiers in Psychology* 11 (590172): 590172. doi:10.3389/fpsyg.2020.590172.
- Kazén, M., and M. Quirin, 2018. "The Integration of Motivation and Volition in Personality Systems Interactions (PSI) Theory." In *Why People Do the Things They Do: Building on Julius Kuhl's Contributions to the Psychology of Motivation and Volition*, edited by N. Baumann, M. Kazein, M. Quirin, and S. L. Koole, 15–30. Göttingen: Hogrefe.
- Lautenbach, F., S. Leisterer, N. Walter, L. Kronenberg, T. Manges, O. Leis, V. Pelikan, S. Gebhardt, and A. M. Elbe. 2021. "Amateur and Recreational Athletes' Motivation to Exercise, Stress, and Coping during the Corona Crisis." *Frontier in Psychology* 11: 611658. doi:10.3389/fpsyg.2020.611658.
- Lesser, I. A., and C. P. Nienhuis. 2020. "The Impact of COVID-19 on Physical Activity Behavior and Well-Being of Canadians." *International Journal of Environmental Research and Public Health* 17 (11): 3899. <https://doi.org/10.3390/ijerph17113899>. doi:10.3390/ijerph17113899.
- Leyton-Roman, M., R. de la Vega, and R. Jimenez-Castuera. 2021. "Motivation and Commitment to Sports Practice during the Lockdown Caused by Covid-19." *Frontiers in Psychology* 11: 622595. doi:10.3389/fpsyg.2020.622595.
- Liberati, Alessandro, Douglas G. Altman, Jennifer Tetzlaff, Cynthia Mulrow, Peter C. Gøtzsche, John P. A. Ioannidis, Mike Clarke, P. J. Devereaux, Jos Kleijnen, and David Moher. 2009. "The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration." *PLoS Medicine* 6 (7): e1000100. doi:10.1371/journal.pmed.1000100.
- Ling, P. 2020. "Interpretation of Leisure Sports in the Pandemic Situation of COVID 19." *World Leisure Journal* 62 (4): 319–321. doi:10.1080/16078055.2020.1828786.
- López, J., G. Perez-Rojo, C. Noriega, I. Carretero, C. Velasco, J. A. Martinez-Huertas, P. López-Frutos, and L. Galarraga. 2020. "Psychological Well-Being among Older Adults during the COVID-19 Outbreak: A Comparative Study of the Young-Old and the Old-Old Adults." *International Psychogeriatrics* 32 (11): 1365–1370. doi:10.1017/S1041610220000964.
- Luciano, F., V. Cenacchi, V. Vegro, and G. Pavei. 2021. "COVID-19 Lockdown: Physical Activity, Sedentary Behaviour and Sleep in Italian Medicine Students." *European Journal of Sport Science* 21 (10): 1459–1468. doi:10.1080/17461391.2020.1842910.
- Luzi, L., and M. G. Radaelli. 2020. "Influenza and Obesity: Its Odd Relationship and the Lessons for COVID-19 Pandemic." *Acta Diabetologica* 57 (6): 759–764. doi:10.1007/s00592-020-01522-8.

- Malcolm, D., and P. Velija. 2020. "COVID-19, Exercise and Bodily Self-Control." *Sociología Del Deporte* 1 (1): 29–34. doi:[10.46661/socioldeporte.5011](https://doi.org/10.46661/socioldeporte.5011).
- Marchant, G., F. Bonaiuto, M. Bonaiuto, and E. Guillet Descas. 2021. "Exercise and Physical Activity eHealth in COVID-19 Pandemic: A Cross-Sectional Study of Effects on Motivations, Behavior Change Mechanisms, and Behavior." *Frontier in Psychology* 12: 1–16. doi:[10.3389/fpsyg.2021.618362](https://doi.org/10.3389/fpsyg.2021.618362).
- Meyer, C., L. Taranis, H. Goodwin, and E. Haycraft. 2011. "Compulsive Exercise and Eating Disorders." *European Eating Disorders Review: The Journal of the Eating Disorders Association* 19 (3): 174–189. doi:[10.1002/erv.1122](https://doi.org/10.1002/erv.1122).
- Meyerowitz-Katz, Gideon, and Lea Merone. 2020. "A Systematic Review and Meta-Analysis of Published Research Data on COVID-19 Infection Fatality Rates." *International Journal of Infectious Diseases* 101: 138–148. doi:[10.1101/2020.05.03.20089854](https://doi.org/10.1101/2020.05.03.20089854).
- Modesti, P. A., G. Reboldi, F. P. Cappuccio, C. Agyemang, G. Remuzzi, S. Rapi, E. Perruolo, G. Parati, and ESH Working Group on CV Risk in Low Resource Settings. 2016. "Panethnic Differences in Blood Pressure in Europe: A Systematic Review and Meta-Analysis." *PLoS One* 11 (1): e0147601. doi:[10.1371/journal.pone.0147601](https://doi.org/10.1371/journal.pone.0147601).
- Moed, H. F., and G. Halevi. 2014. "A Bibliometric Approach to Tracking International Scientific Migration." *Scientometrics* 101 (3): 1987–2001. doi:[10.1007/s11192-014-1307-6](https://doi.org/10.1007/s11192-014-1307-6).
- Moore, Sarah A., Guy Faulkner, Ryan E. Rhodes, Mariana Brussoni, Tala Chulak-Bozzer, Leah J. Ferguson, Raktim Mitra, et al. 2020. "Impact of the COVID-19 Virus Outbreak on Movement and Play Behaviours of Canadian Children and Youth: A National Survey." *The International Journal of Behavioral Nutrition and Physical Activity* 17 (1): 85. doi:[10.1186/s12966-020-00987-8](https://doi.org/10.1186/s12966-020-00987-8).
- Mutz, M., and M. Gerke. 2021. "Sport and Exercise in Times of Self-Quarantine: How Germans Changed Their Behavior at the Beginning of the Covid-19 Pandemic." *International Review for the Sociology of Sport* 56 (3): 305–316. doi:[10.1177/1012690220934335](https://doi.org/10.1177/1012690220934335).
- Mutz, M., J. Müller, and A. K. Reimers. 2021. "Use of Digital Media for Home-Based Sports Activities during the COVID-19 Pandemic: Results from the German SPOVID Survey." *International Journal of Environmental Research and Public Health* 18 (9): 4409. doi:[10.3390/ijerph18094409](https://doi.org/10.3390/ijerph18094409).
- Narici, Marco, Giuseppe De Vito, Martino Franchi, Antonio Paoli, Tatiana Moro, Giuseppe Marcolin, Bruno Grassi, et al. 2021. "Impact of Sedentarism Due to the COVID-19 Home Confinement on Neuromuscular, Cardiovascular and Metabolic Health: Physiological and Pathophysiological Implications and Recommendations for Physical and Nutritional countermeasures." *European Journal of Sport Science* 21 (4): 614–635. doi:[10.1080/17461391.2020.1761076](https://doi.org/10.1080/17461391.2020.1761076).
- Okazaki, K., K. Suzuki, Y. Sakamoto, and K. Sasaki. 2015. "Physical Activity and Sedentary Behavior among Children and Adolescents Living in an Area Affected by the 2011 Great East Japan Earthquake and Tsunami for 3 Years." *Preventive Medicine Reports* 2: 720–724. doi:[10.1016/j.pmedr.2015.08.010](https://doi.org/10.1016/j.pmedr.2015.08.010).
- Perianes-Rodriguez, A., L. Waltman, and N. J. Van Eck. 2016. "Constructing Bibliometric Networks: A Comparison between Full and Fractional Counting." *Journal of Informetrics* 10 (4): 1178–1195. doi:[10.1016/j.joi.2016.10.006](https://doi.org/10.1016/j.joi.2016.10.006).
- Phillipou, A., D. Meyer, E. Neill, E. J. Tan, W. L. Toh, T. E. Van Rheenen, and S. L. Rossell. 2020. "Eating and Exercise Behaviors in Eating Disorders and the General Population during the COVID-19 Pandemic in Australia: Initial Results from the COLLATE Project." *International Journal of Eating Disorder* 53 (7): 1165. doi:[10.1002/eat.23317](https://doi.org/10.1002/eat.23317).
- Portegijs, E., K. E. Keskinen, E.-M. Tuomola, T. Hinrichs, M. Saajanaho, and T. Rantanen. 2021. "Older Adults' Activity Destinations Before and during COVID-19 Restrictions: From a Variety of Activities to Mostly Physical Exercise Close to Home." *Health & Place* 68: 102533. doi:[10.1016/j.healthplace.2021.102533](https://doi.org/10.1016/j.healthplace.2021.102533).
- Putnam, H. 2002. *The Collapse of the Fact/Value Dichotomy and Other Essays*. Cambridge, MA: Harvard University Press
- Reicher, S., and C. Stott. 2020. "On Order and Disorder during the COVID-19 Pandemic." *British Journal Social Psychology* 59: 694–702. doi:[10.1111/bjso.12398](https://doi.org/10.1111/bjso.12398).

- Reinboth, M., and J. L. Duda. 2006. "Perceived Motivational Climate, Need Satisfaction and Indices of Well-Being in Team Sports: A Longitudinal Perspective." *Psychology of Sport and Exercise* 7 (3): 269–286. doi:10.1016/j.psychsport.2005.06.002.
- Robb, Catherine E., Celeste A. de Jager, Sara Ahmadi-Abhari, Parthenia Giannakopoulou, Chinedu Udeh-Momoh, James McKeand, Geraint Price, et al. 2020. "Associations of Social Isolation with Anxiety and Depression during the Early COVID-19 Pandemic: A Survey of Older Adults in London, UK." *Front Psychiatry* 11(: 591120. doi:10.3389/fpsy.2020.591120.
- Robertson, M., F. Duffy, E. Newman, C. Prieto Bravo, H. H. Ates, and H. Sharpe. 2021. "Exploring Changes in Body Image, Eating and Exercise during the COVID-19 Lockdown: A UK Survey." *Appetite* 159: 105062. doi:10.1016/j.appet.2020.105062.
- Ronkainen, N. J., A. J. Pesola, O. Tikkanen, and R. Brand. 2021. "Continuity and Discontinuity of Sport and Exercise Type during the COVID-19 Pandemic. An Exploratory Study of Effects on Mood." *Frontiers in Psychology* 12: 622876. doi:10.3389/fpsyg.2021.622876.
- Rowe, D. 2020. "Subjecting Pandemic Sport to a Sociological Procedure." *Journal of Sociology* 56 (4): 704–713. doi:10.1177/1440783320941284.
- Ruffault, A., M. Bernier, J. Fournier, and N. Hauw. 2020. "Anxiety and Motivation to Return to Sport during the French COVID-19 Lockdown." *Frontiers in Psychology* 11: 610882. doi:10.3389/fpsyg.2020.610882.
- Samuel, R. D., G. Tenenbaum, and Y. Galily. 2020. "The 2020 Coronavirus Pandemic as a Change-Event in Sport Performers' Careers: Conceptual and Applied Practice Considerations." *Frontiers in Psychology* 11: 567966. doi:10.3389/fpsyg.2020.567966.
- Schlossberg, N. K. 1981. "A Model for Analyzing Human Adaptation to Transition." *The Counseling Psychologist* 9 (2): 2–18. doi:10.1177/001100008100900202.
- Schnitzer, M., S. E. Schöttl, M. Kopp, and M. Barth. 2020. "COVID-19 Stay-at-Home Order in Tyrol, Austria: Sports and Exercise Behaviour in Change?" *Public Health* 185 (220): 218–220. doi:10.1016/j.puhe.2020.06.042.
- Son, J. S., G. Nimrod, S. T. West, M. C. Janke, T. Liechty, and J. J. Naar. 2021. "Promoting Older Adults' Physical Activity and Social Well-Being during COVID-19." *Leisure Sciences* 43 (1–2): 287–294. doi:10.1080/01490400.2020.1774015.
- Sport England. 2020. "Exploring Attitudes and Behaviours in England during the Covid-19 Pandemic." Accessed January 15, 2021. <https://indd.adobe.com/view/793b48d5-bbcd-4de3-a50f-11d241a506b3>
- Stanton, R., Q. G. To, S. Khalesi, S. L. Williams, S. J. Alley, T. L. Thwaite, A. S. Fenning, and C. Vandelanotte. 2020. "Depression, Anxiety, and Stress during COVID-19: Associations with Changes in Physical Activity, Sleep, Tobacco, and Alcohol Use in Australian Adults." *International Journal of Environmental Research and Public Health* 17 (11): 4065. doi:10.3390/ijerph1711.14065.
- Stockwell, S., M. Trott, M. Tully, J. Shin, Y. Barnett, L. Butler, D. McDermott, F. Schuch, and L. Smith. 2021. "Changes in Physical Activity and Sedentary Behaviours from before to during the COVID-19 Pandemic Lockdown: A Systematic Review." *BMJ Open Sport & Exercise Medicine* 7 (1): e000960. doi:10.1136/bmjsem-2020-000960.
- Szabo, A. 2010. *Addiction to Exercise: A Symptom or a Disorder?* New York: Nova Science Publishers.
- Szabo, Attila, Szilvia Boros, and Júlia Patakiné Bösze. 2019. "Are There Differences in Life-Satisfaction, Optimism, Pessimism and Perceived Stress between Therapeutic and Mastery Exercisers? A Preliminary Investigation." *Baltic Journal of Sport and Health Sciences* 3: 114. doi:10.33607/bjshs.v3i114.807.
- Van Eck, N. J., and L. Waltman. 2014. "Visualizing Bibliometric Networks." In Y. Ding, R. Rousseau, and D. Wolfram (Eds.), *Measuring Scholarly Impact: Methods and Practice*, 285–320. Cham: Springer.
- Webster, J., and R. T. Watson. 2002. "Analyzing the Past to Prepare for the Future." *MIS Quarterly* 26 (2): 13–23.
- Wells, G. A., B. Shea, and D. O'Connell. 2009. *The Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Nonrandomised Studies in Meta-Analyses*. Ottawa, ON: Ottawa Hospital Research Institute.

- Wilke, Jan, Lisa Mohr, Adam S. Tenforde, Pascal Edouard, Chiara Fossati, Marcela González-Gross, Celso Sánchez Ramírez, et al. 2021. "A Pandemic within the Pandemic? Physical Activity Levels Have Substantially Decreased in Countries Affected by COVID-19." *International Journal of Environmental Research and Public Health* 18 (5): 2235. doi:[10.3390/ijerph18052235](https://doi.org/10.3390/ijerph18052235).
- Young, M. E. M. 2020. "Leisure Pursuits in South Africa as Observed during the COVID-19 Pandemic." *World Leisure Journal* 62 (4): 331–335. doi:[10.1080/16078055.2020.1825252](https://doi.org/10.1080/16078055.2020.1825252).

Appendix

Table A.1. Articles included in the qualitative literature review.

Author(s)	Approach
Andersson and Andreasson (2021)	Empirical
Andersson et al. (2021)	Empirical
Ammar et al. (2020)	Empirical
Brand et al. (2020)	Empirical
Burtscher, Burtscher, and Millet (2020)	Empirical
Cheval et al. (2021)	Empirical
Clemente-Suárez et al. (2021)	Empirical
Chen et al. (2020)	Empirical
De Lannoy et al. (2020)	Empirical
De la Cámara, Jiménez-Fuente, and Pardos-Sevilla (2020)	Empirical
De la Vega et al. (2020)	Empirical
De Jong, Fish, and Hertel (2021)	Empirical
De Miranda (2020)	Empirical
Dwyer et al. (2020)	Empirical
Flanagan et al. (2021)	Empirical
Hall et al. (2021)	Empirical
Iancheva et al. (2020)	Empirical
Ibrahim et al. (2021)	Empirical
Karipidis and Steinfeld (2020)	Empirical
Kaur et al. (2020)	Empirical
Lautenbach et al. (2021)	Empirical
Leyton-Roman, de la Vega, and Jimenez-Castuera (2021)	Empirical
Ling (2020)	Empirical
Luzi and Radaelli (2020)	Empirical
Malcolm and Velija (2020)	Empirical
Marchant et al. (2021)	Empirical
Moore et al. (2020)	Empirical
Mutz and Gerke (2021)	Empirical
Mutz, Müller, and Reimers (2021)	Empirical
Narici et al. (2021)	Empirical
Phillipou et al. (2020)	Empirical
Reicher and Stott (2020)	Empirical
Robb et al. (2020)	Empirical
Robertson et al. (2021)	Empirical
Ruffault et al. (2020)	Empirical
Samuel, Tenenbaum, and Galily (2020)	Empirical
Schnitzer et al. (2020)	Empirical
Son et al. (2021)	Empirical
Sport England (2020)	Empirical
Stockwell et al. (2021)	Empirical
Young (2020)	Empirical
Wilke et al. (2021)	Empirical